Company: DOVEN LLC

Test of: DVD21-POE

To: FCC Part 15 Subpart F 15.517 - Indoor UWB Devices

Report No.: JANU02-U4 Rev A

TEST REPORT

COMBINED TEST REPORT

FROM

Test of: DOVEN LLC – DVD21-POE

To: FCC CFR 47 Part 15 Subpart F 15.517 – Indoor UWB Systems

Test Report Serial No.: JANU02-U4 Rev A

This report supersedes: NONE

Applicant:	DOVEN LLC 2408 Timberloch PL Ste A6 The Woodlands TX 77380 USA
Product Function:	Distance Measurement
Issue Date:	20th March 2019

This Test Report is Issued Under the Authority of:

MiCOM Labs, Inc.
575 Boulder Court
Pleasanton California 94566
USA
Phone: +1 (925) 462-0304
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www.micomlabs.com

TESTING CERT #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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1. ACCREDITATION, LISTINGS & RECOGNITION

1.1. Test Accreditation

MiCOM Labs, Inc. an accredited laboratory complies with the international standard EN ISO/IEC 17025. The company is accreditedby the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-01.pdf

Accredited Laboratory

A2LA has accredited

MiCOM LABS

Pleasanton, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 14th day of May 2018.

President and CEO
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2019

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

1.2. Recognition

MiCOM Labs, Inc has widely recognized Electrical testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA** countries. Our test reports are widely accepted for global type approvals.

Country	Recognition Body	Status	Phase	Identification No.
model	Federal Communications Commission (FCC)	TCB	-	US0159 Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	US0159 Listing #: 4143A-2 4143A-3
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	APEC MRA 2	RCB 210
	VCCI	--	--	A-0012
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

**APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries
Phase I - recognition for product testing
Phase II – recognition for both product testing and certification
N/A – Not Applicable

**EU MRA – European Union Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the EU member countries

**NB – Notified Body

1.3. Product Certification

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-02.pdf

Accredited Product Certification Body

A2LA has accredited

MiCOM LABS

Pleasanton, CA

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 *Requirements for bodies certifying products, processes and services*. This product certification body also meets the *A2LA R322 – Specific Requirements – Notified Body Accreditation Requirements* and *A2LA R308 - Specific Requirements - ISO-IEC 17065 - Telecommunication Certification Body Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a management system.

Presented this 14th day of May 2018

President and CEO
For the Accreditation Council
Certificate Number 2381.02
Valid to November 30, 2019

For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation.

United States of America – Telecommunication Certification Body (TCB)
TCB Identifier – US0159

Industry Canada – Certification Body
CAB Identifier – US0159

Europe – Notified Body
Notified Body Identifier - 2280

Japan – Recognized Certification Body (RCB)
RCB Identifier – 210

2. DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft	21st January 2019	Draft for client review
Rev A	20th March 2019	Initial Release

In the above table the latest report revision will replace all earlier versions.

3. TEST RESULT CERTIFICATE

Manufacturer: DOVEN LLC 2408 Timberloch PL Ste A6 The Woodlands TX 77380 USA	**Tested By:** MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Model(s): DVD21-POE	**Telephone:** +1 925 462 0304 **Fax:** +1 925 462 0306
Equipment Type: Distance Measurement	
S/N's: 19010901	
Test Date(s): 9th – 14th January 2019	**Website:** www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC CFR 47 Part 15 Subpart F 15.517	EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:
1. This document reports conditions under which testing was conducted and the results of testing performed.

2. Details of test methods used have been recorded and kept on file by the laboratory.

3. Test results apply only to the item(s) tested.

A2LA ACCREDITED
TESTING CERT #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs, Inc.

Gordon Hurst
President & CEO MiCOM Labs, Inc.

4. REFERENCES AND MEASUREMENT UNCERTAINTY

4.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
I	FCC 47 CFR Part F	2018	Radio Frequency Devices; Subpart F – Ultra Wide Band Devices
II	A2LA	August 2017	R105 - Requirement's When Making Reference to A2LA Accreditation Status
III	ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices
IV	ANSI C63.4	2014	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
V	ETSI TR 100 028	2001-12	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
VI	M 3003	Edition 3 Nov.2012	Expression of Uncertainty and Confidence in Measurements
VII	FCC 47 CFR Part 2.1033	2016	FCC requirements and rules regarding photographs and test setup diagrams.
VIII	KDB 393764 D01 UWB FAQ v02	January 29, 2018	Ultra-Wideband (UWB) Devices frequently asked questions

4.2. Test and Uncertainty Procedure

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

5. PRODUCT DETAILS AND TEST CONFIGURATIONS

5.1. Technical Details

Details	Description
Purpose:	Test of the DOVEN DVD21-POE to FCC CFR 47 Part 15 Subpart F 15.517
Applicant:	DOVEN LLC 2408 Timberloch PL Ste A6 The Woodlands TX 77380 USA
Manufacturer:	As applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Test report reference number:	JANU01-U2
Date EUT received:	29th January 2018
Standard(s) applied:	FCC CFR 47 Part 15 Subpart F 15.517
Dates of test (from - to):	9th – 14th January 2019
No of Units Tested:	4
Product Family Name:	DOVEN
Model(s):	DVD21-POE
Location for use:	No fixed location Primarily hand held
Declared Frequency Range(s):	3100-10600 MHz
Type of Modulation:	BPM/BPSK
EUT Modes of Operation:	500 MHz Bandwidth
Declared Nominal Output Power (dBm):	-41 dBm
Transmit/Receive Operation:	Transceiver
Rated Input Voltage and Current:	8-50 $V_{DC,}$, 10W (POE Powered)
Operating Temperature Range:	-20 ~ +75°C
ITU Emission Designator:	500MX0D
Equipment Dimensions:	14 x 14 x 2 in
Weight:	DVD21-POE: 4 LB
Hardware Rev:	2.0.1
Software Rev:	2.0.5

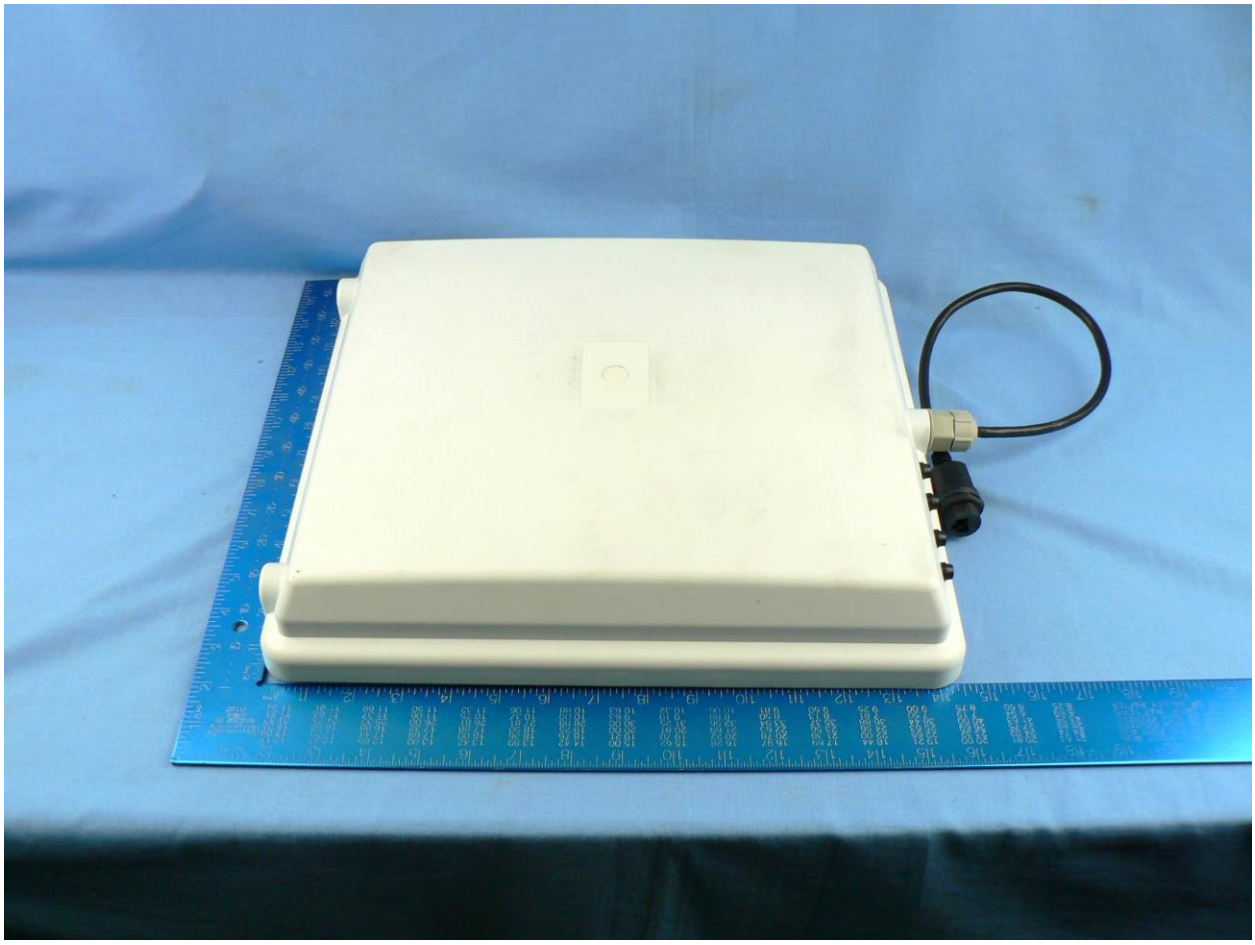
5.2. Scope Of Test Program

The scope of the test program was to test the Janus Automation DOVEN DVD21-POE configuration in the frequency ranges 3100 - 10600 MHz for compliance against the following specification:

FCC CFR 47 Part 15 Subpart F – 15.517
Technical requirements for hand held UWB systems
.

DVD21-POE

Front View



5.3. Equipment Model(s) and Serial Number(s)

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr.	Model No.	Serial No.
EUT	POE Unit with integrated directional antenna	DOVEN LLC	DVD21-POE	19010901

5.4. Antenna Details

Type	Manufacturer	Model	Family	Gain (dBi)	BF Gain	Dir BW	X-Pol	Frequency Band (MHz)
Integral	DOVEN LLC	DVD21-POE	Wide	9.28	--	--	No	3250 - 4250

BF Gain - Beamforming Gain
Dir BW - Directional BeamWidth
X-Pol - Cross Polarization

5.5. Cabling and I/O Ports

None

5.6. Test Configurations

Results for the following configurations are provided in this report:

Channel Bandwidth(s)	Transmission Rate	Channel Frequency (MHz)		
		Low	Mid	High
500MHz	6.8 Mbit/s	Single Frequency 3500.00		

5.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:
1. NONE

5.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:
1. NONE

6. TEST SUMMARY

List of Measurements

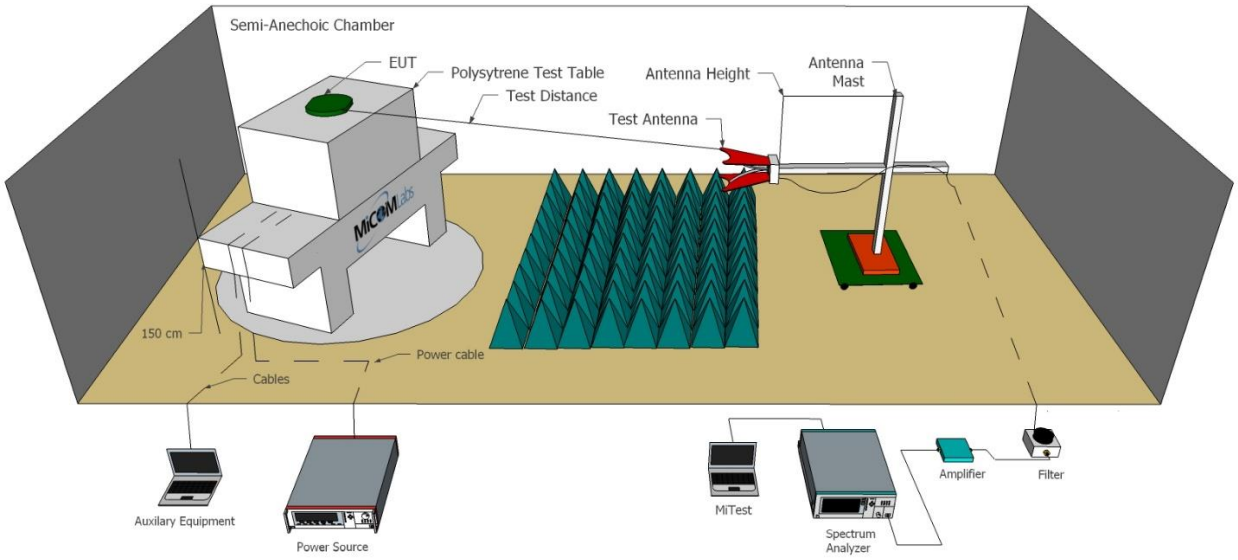
Test Header	Result	Data Link
Radiated Test Methodology		
UWB Bandwidth	Complies	View Data
Radiated Power	Complies	View Data
Peak Power Density	Complies	View Data
Spurious Radiated Emissions 30 MHz - 1000 MHz	Complies	View Data
Spurious Radiated Emissions 1000 MHz - 18000 MHz	Complies	View Data
Spurious Radiated Emissions in GPS Bands	Complies	View Data
Comments: None		

7. TEST EQUIPMENT CONFIGURATION(S)

7.1. Radiated Emissions - 3m Chamber

The following tests were performed using the radiated test set-up shown in the diagram below. Radiated emissions above 1GHz.

Radiated Emissions Above 1GHz Test Setup



A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
170	Video System Controller for Semi Anechoic Chamber	Panasonic	WV-CU101	04R08507	Not Required
298	3M Radiated Emissions Chamber Maintenance Check	MiCOM	3M Chamber	298	21 Jan 2019
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	4 Apr 2019
373	26III RMS Multimeter	Fluke	Fluke 26 series III	76080720	21 Sep 2019
377	Band Rejection Filter 5150 to 5880MHz	Microtronics	BRM50716	034	9 Oct 2019
378	Rohde & Schwarz 40 GHz Receiver with Generator	Rhode & Schwarz	ESIB40	100107/040	12 Oct 2019
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	12 Feb 2019
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	12 Oct 2019
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	12 Feb 2019
410	Desktop Computer	Dell	Inspiron 620	WS38	Not Required
411	Mast/Turntable Controller	Sunol Sciences	SC98V	060199-1D	Not Required
412	USB to GPIB Interface	National Instruments	GPIB-USB HS	11B8DC2	Not Required
413	Mast Controller	Sunol Science	TWR95-4	030801-3	Not Required
414	DC Power Supply 0-60V	HP	6274	1029A01285	Cal when used
415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
447	MiTest Rad Emissions Test Software	MiCOM	Rad Emissions Test Software Version 1.0	447	Not Required
462	Schwarzbeck cable from Antenna to Amplifier.	Schwarzbeck	AK 9513	462	9 Oct 2019
463	Schwarzbeck cable from Amplifier to Bulkhead.	Schwarzbeck	AK 9513	463	9 Oct 2019
464	Schwarzbeck cable from Bulkhead to Receiver	Schwarzbeck	AK 9513	464	9 Oct 2019
465	Low Pass Filter DC-1000 MHz	Mini-Circuits	NLP-1200+	VUU01901402	9 Oct 2019
466	Low Pass Filter DC-1500 MHz	Mini-Circuits	NLP-1750+	VUU10401438	9 Oct 2019

470	High Pass filter	Mini Circuits	SHP-700	None	9 Oct 2019
480	Cable - Bulkhead to Amp	SRC Haverhill	157-3050360	480	24 Aug 2019
481	Cable - Bulkhead to Receiver	SRC Haverhill	151-3050787	481	24 Aug 2019
510	Barometer/Thermometer	Control Company	68000-49	170871375	11 Dec 2019
518	Cable - Amp to Antenna	SRC Haverhill	157-3051574	518	24 Aug 2019
CC05	Confidence Check	MiCOM	CC05	None	21 Jan 2019

8. MEASUREMENT AND PRESENTATION OF TEST DATA

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by MiTest. MiTest is an automated test system developed by MiCOM Labs. MiTest is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.

The MiCOM Labs "MiTest" Automated Test System" (Patent Pending)

9. TEST RESULTS

9.1. UWB Bandwidth

Conducted Test Conditions for 26 dB and 99% Bandwidth			
Standard:	FCC CFR 47:15.517	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	UWB Bandwidth	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	ANSI C63.10 Section 10.1	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for UWB Bandwidth Measurement
The UWB Bandwidth is measured radiated, at a 3-meter distance, while EUT is operating in transmission mode at the appropriate center frequency. The Resolution Bandwidth was set to 1MHz RBW IAW ANSI C63.10.
Testing was performed under ambient conditions at nominal voltage.

Test configuration and setup used for the measurement was per the Radiated Test Set-up section specified in this document.

Equipment Configuration for UWB Bandwidth			
Variant:	500 MHz Bandwidth	**Duty Cycle (%):**	100
Data Rate:	-	**Antenna Gain (dBi):**	9.28
Modulation:	BPM/BPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

DVD21-POE

Test Frequency	Measured 10 dB Bandwidth (MHz)	10 dB Bandwidth (MHz)			
MHz	Port A	Highest	Lowest		
3500.00	501.97	501.97	501.97		

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

The above values are representative of the worst case value between polarities and based on the power measurements.

9.2. Peak Transmit Power

Conducted Test Conditions for Maximum Radiated Output Power			
Standard:	FCC CFR 47:15.517 (c)	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Radiated Emissions UWB Transmission	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	ANSI C63.10 Section 10.3.5	**Pressure (mBars):**	999 - 1001
Reference Document(s):	None		

Test Procedure for UWB Transmission

Testing was performed under ambient conditions at nominal voltage.

Test configuration and setup used for the measurement was per the Radiated Test Set-up section specified in this document. Supporting KDB's referenced below.

Operating Frequency Band:
3100-10600 MHz

Limits Maximum EIRP (dBm)

Frequency (MHz)	EIRP Limit (dBm)	EIRP at 3 Meters (dBuv/m)
3100 - 10600	-41.3	53.9

Equipment Configuration for RF Output Power			
Variant:	500 MHz Bandwidth	**Duty Cycle (%):**	99
Data Rate:	-	**Antenna Gain (dBi):**	9.28
Modulation:	BPM/BPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JMH
Engineering Test Notes:			

Test Measurement Results

Test Frequency MHz	Measured Output Power (dBuv/m)	Calculated Total Power	Limit	Margin	EUT Power Setting
	Port A	dBuv/m	dBuv/m	Numeric	Numeric
DVD21-POE	49.7	49.7	53.9	-4.2	8

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Uncertainty:	±1.33 dB

9.3. Peak Power Density

Radiated Test Conditions for Maximum Peak Power Density			
Standard:	FCC CFR 47:15.517 (e)	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Radiated Emissions UWB Transmission	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	ANSI C63.10 Section 10.3.6	**Pressure (mBars):**	999 - 1001
Reference Document(s):	None		

Test Procedure for UWB Transmission

Testing was performed under ambient conditions at nominal voltage.

Test configuration and setup used for the measurement was per the Radiated Test Set-up section specified in this document. Supporting KDB's referenced below.

Measurements were gathered with a RBW of 1MHz and converted to 50MHz using the following formula:

$EIRP_{1\ MHz} = EIRP_{50\ MHz} + 20\log(1MHz/50MHz) = 0dBm + (-34dBm) = -34dBm$

Operating Frequency Band:
3100-10600 MHz

Limits Maximum EIRP (dBm)

Frequency (MHz)	EIRP Limit (dBm/50MHz)	EIRP Limit (dBm/1MHz)	EIRP at 3 Meters (dBuv/m)
3100 - 10600	0	-34	61.23

Equipment Configuration for Peak Power Density			
Variant:	500 MHz Bandwidth	**Duty Cycle (%):**	99
Data Rate:	-	**Antenna Gain (dBi):**	9.28
Modulation:	BPM/BPSK	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	JH
Engineering Test Notes:			

Test Measurement Results

Device	Measured Output Power	Limit	Margin	EUT Power Setting
	dBuv/m	dBuv/m	Numeric	Numeric
DVD21-POE	59.51	61.23	-1.72	8

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Uncertainty:	±1.33 dB

9.4. Radiated Spurious Emissions

Radiated Test Conditions for Radiated Spurious and Band-Edge Emissions			
Standard:	FCC CFR 47 15.517	**Ambient Temp. (ºC):**	20.0 - 24.5
Test Heading:	Radiated Spurious and Band-Edge Emissions	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	ANSI C63.10 Section 10.2 + 10.3	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Radiated Spurious and Band-Edge Emissions
Radiated emissions for restricted bands above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned.
Measurements on any restricted band frequency or frequencies above 1 GHz are based on the use of measurement instrumentation employing peak and average detectors. All measurements were performed using a resolution bandwidth of 1 MHz.

Limits for Restricted Bands (15.205, 15.209)
Peak emission: 68.23 dBuV/m
Average emission: 54 dBuV/m

Field Strength Calculation
The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.
FS = R + AF + CORR - FO

where:
FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss

Frequency Range		Limit	
MHz	**MHz**	**EIRP (dBm)**	**EIRP at 3 Meters (dBuV/m)**
960	1610	-75.3	19.9
1610	1990	-63.3	41.9
1990	3100	-61.3	43.9
3100	10600	-41.3	53.9
10600	18000	-61.3	43.9

Radiated Spurious Emissions in the GPS Bands 15.517 (d)

Frequency Range		Limit	
MHz	**MHz**	**EIRP (dBm)**	**EIRP at 3 Meters (dBuV/m)**
1164	**1240**	**-85.3**	**9.9**
1559	**1610**	**-85.3**	**9.9**

9.4.1. TX Spurious Band Emissions

9.4.1.1. DVD21-POE

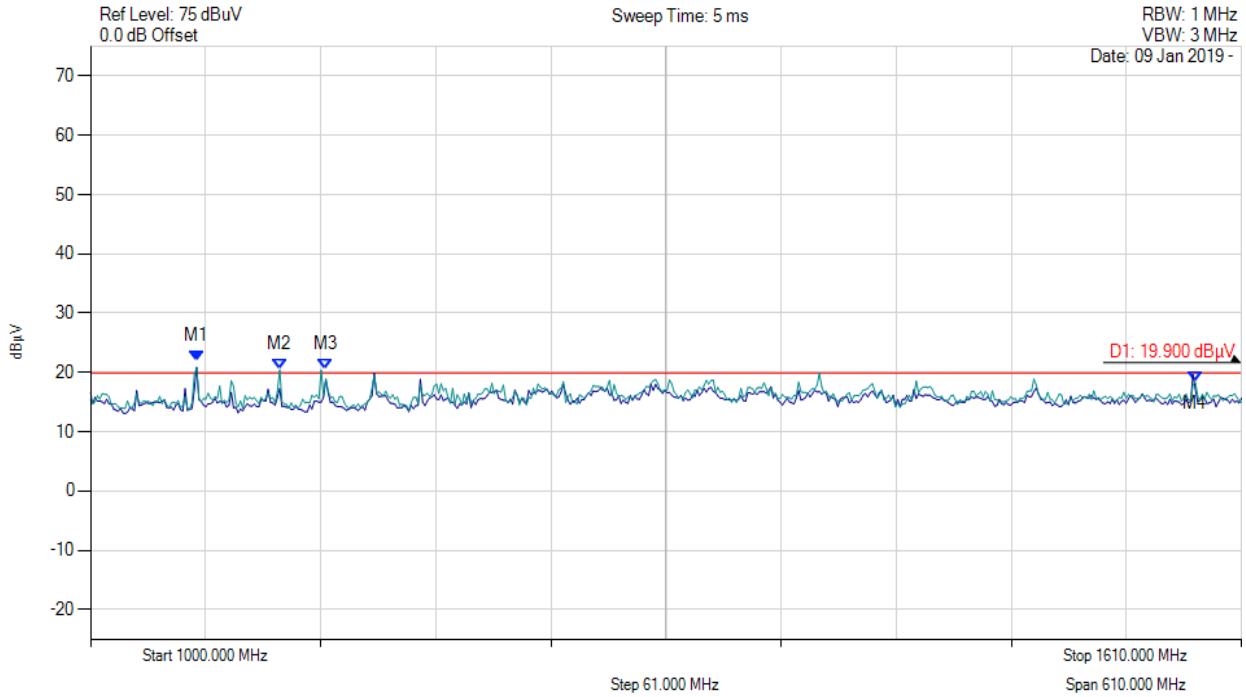
Note: M1-M4 are digital emissions, see next plot

Equipment Configuration for Spurious Emissions			
Antenna:	DVD21-POE	**Variant:**	500 MHz Bandwidth
Antenna Gain (dBi):	9.28	**Modulation:**	BPM/BPSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99%
Channel Frequency (MHz):	3500.00	**Data Rate:**	
Power Setting:	8	**Tested By:**	JMH

Test Measurement Results

TX Spur 1.61 - 1.99 G

Variant: TX Spur 1-1.6, Channel: 3550.00 MHz, Chain a, Temp: 16, Voltage: 16 Vdc

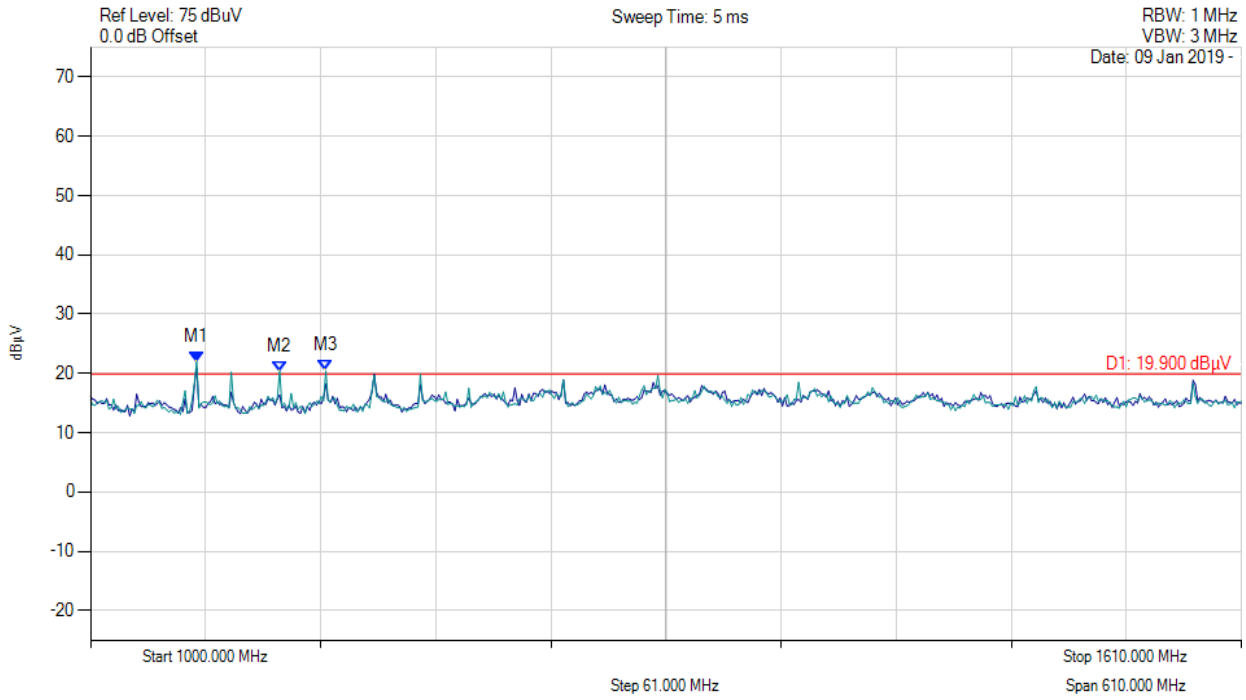


Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Sweep Count = 0 RF Atten (dB) = 10 TRACE 1: Detector = RMS Trace Mode = VIEW TRACE 2: Detector = RMS Trace Mode = VIEW	M1 : 1056.232 MHz : 21.838 dBµV M2 : 1100.241 MHz : 20.464 dBµV M3 : 1124.681 MHz : 20.571 dBµV M4 : 1585.551 MHz : 18.399 dBµV **Notes: M1 – M4 are digital emissions, see next plot.**	Channel Frequency: 3500.00 MHz

Digital Emissions:

Digital 1.61 - 1.99 G

Variant: 1-1.6 Digital, Channel: 3500.00 MHz, Chain a, Temp: 16, Voltage: 16 Vdc



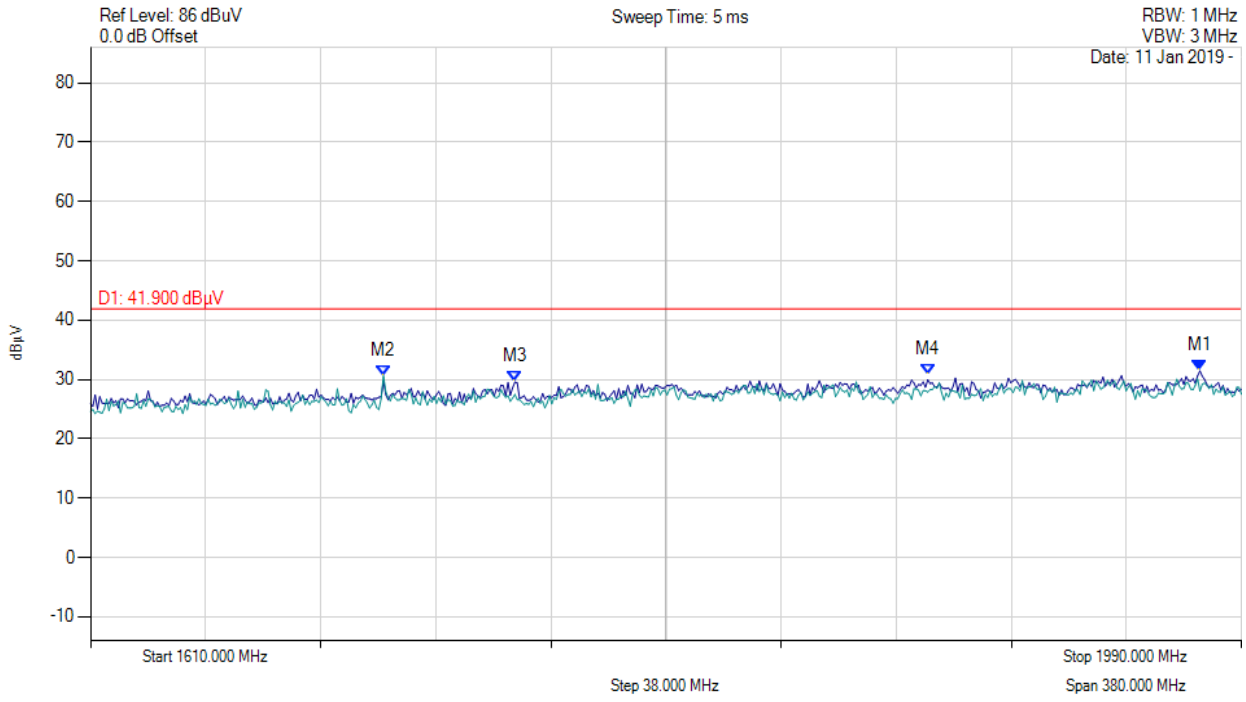
Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Sweep Count = 0 RF Atten (dB) = 10 TRACE 1: Detector = RMS Trace Mode = VIEW TRACE 2: Detector = RMS Trace Mode = VIEW	M1 : 1056.232 MHz : 21.985 dBµV M2 : 1100.240 MHz : 20.340 dBµV M3 : 1124.689 MHz : 20.421 dBµV	Channel Frequency: 3550.00 MHz

Equipment Configuration for Spurious Emissions			
Antenna:	DVD21-POE	**Variant:**	500 MHz Bandwidth
Antenna Gain (dBi):	9.28	**Modulation:**	BPM/BPSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99%
Channel Frequency (MHz):	3500.00	**Data Rate:**	
Power Setting:	8	**Tested By:**	JMH

Test Measurement Results

TX Spur 1.61 - 1.99 MHz

Variant: DVD21 TX Spur 1.61 - 1.99 MHz, Channel: 3500.00 MHz, Chain a, Temp: 16, Voltage: 16 Vdc



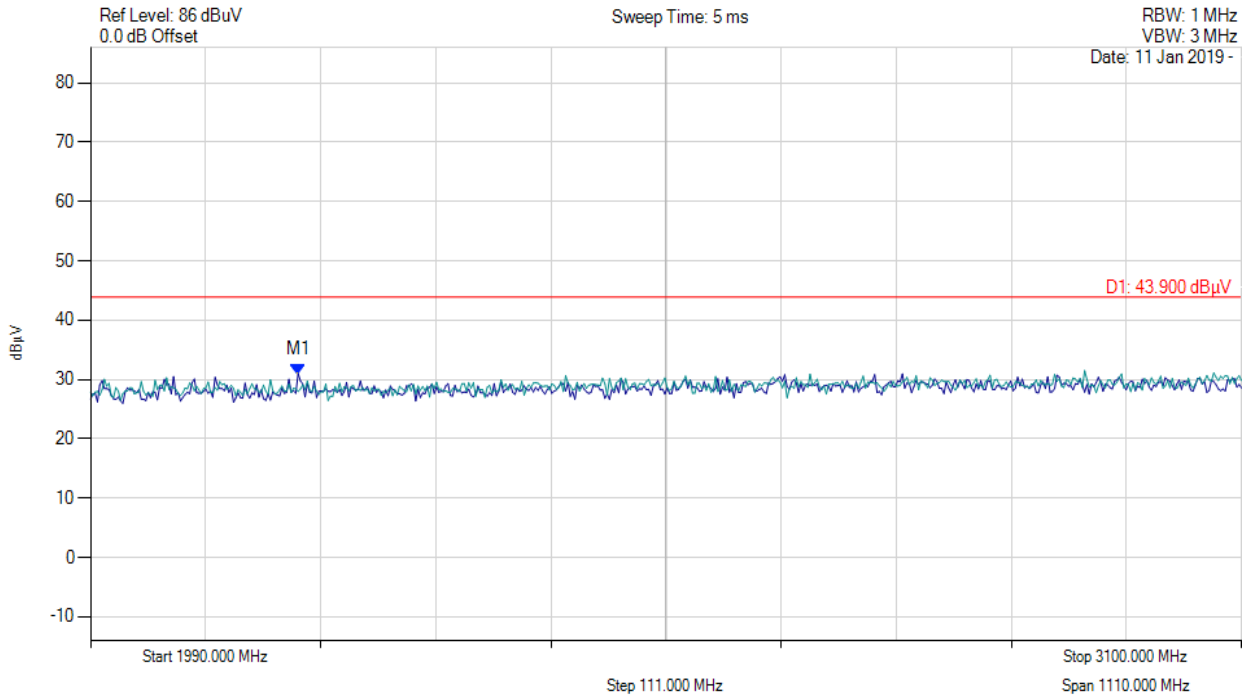
1610.00 - 1990.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	1976.29	42.9	1.61	-13.06	31.45	RMS	Vertical	150	0	41.9	-10.45	Pass
2	1706.71	44.9	1.51	-15.8	30.61	RMS	Vertical	150	0	41.9	-11.29	Pass
3	1750.12	43.22	1.5	-15.15	29.57	RMS	Vertical	150	0	41.9	-12.33	Pass
4	1886.43	43.14	1.55	-13.78	30.91	RMS	Vertical	150	0	41.9	-10.99	Pass

Equipment Configuration for Restricted Band Spurious Emissions			
Antenna:	DVD21-POE	**Variant:**	500 MHz Bandwidth
Antenna Gain (dBi):	9.28	**Modulation:**	BPM/BPSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99%
Channel Frequency (MHz):	3500.00	**Data Rate:**	
Power Setting:	8	**Tested By:**	JMH

Test Measurement Results

TX Spur 1.99-3.1 MHz

Variant: DVD21 TX Spur 1.99 - 3.1 MHz, Channel: 3500.00 MHz, Chain a, Temp: 16, Voltage: 16 Vdc



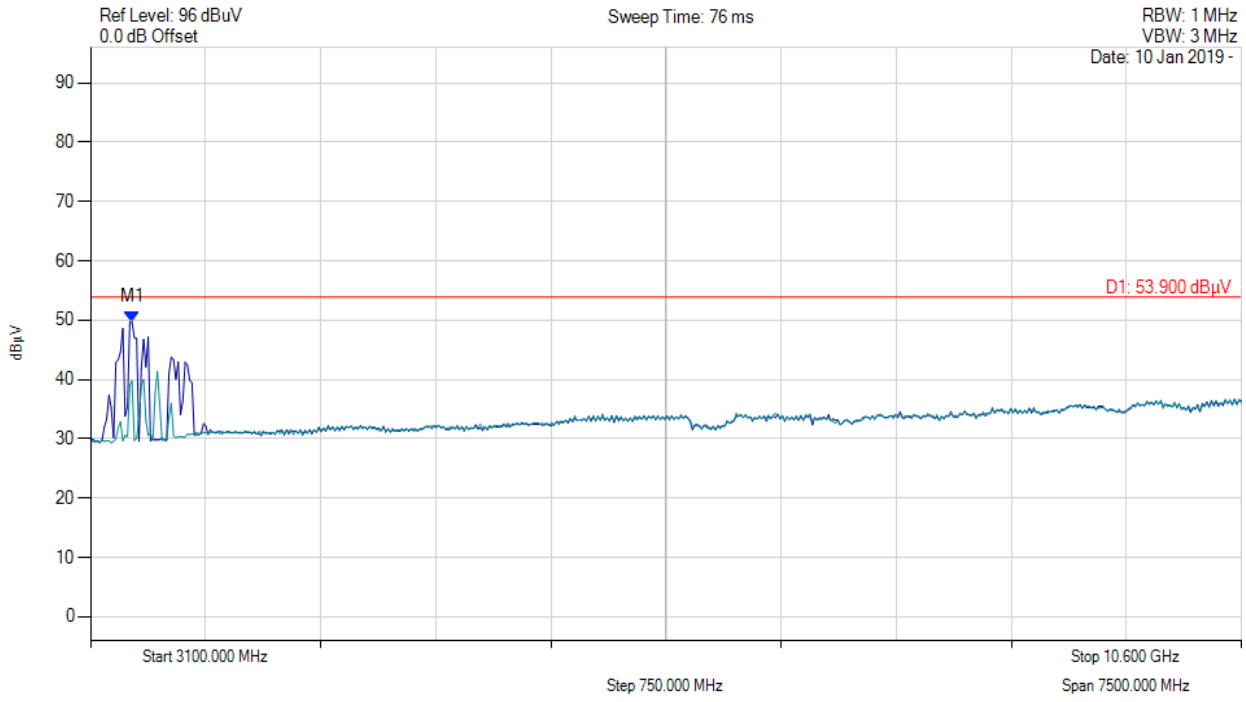
1990.00 – 3100.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	2190.2	41.92	1.69	-12.75	30.86	RMS	Vertical	150	0	43.9	-13.04	Pass

Equipment Configuration for Restricted Band Spurious Emissions			
Antenna:	DVD21-POE	**Variant:**	500 MHz Bandwidth
Antenna Gain (dBi):	9.28	**Modulation:**	BPM/BPSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99%
Channel Frequency (MHz):	3500.00	**Data Rate:**	
Power Setting:	8	**Tested By:**	JMH

Test Measurement Results

TX Spur 3.1-10.6 G

Variant: TX Spur 3.1-10.6, Channel: 3500.00 MHz, Chain a, Temp: 14, Voltage: 16 Vdc



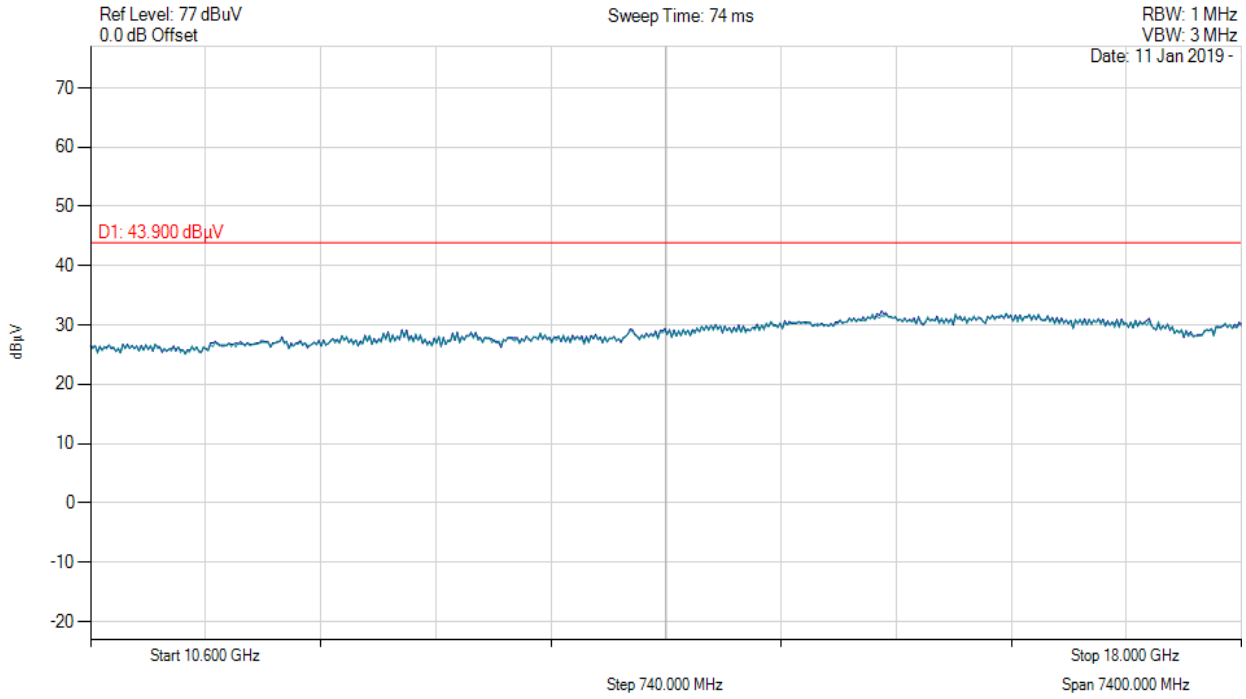
1990.00 – 3100.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	3370.54	2.08	-1.61	-11.84	49.69	RMS	Vertical	150	0	53.9	-4.21	Pass

Equipment Configuration for Restricted Band Spurious Emissions			
Antenna:	DVD21-POE	**Variant:**	500 MHz Bandwidth
Antenna Gain (dBi):	9.28	**Modulation:**	BPM/BPSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99%
Channel Frequency (MHz):	3500.00	**Data Rate:**	
Power Setting:	8	**Tested By:**	JMH

Test Measurement Results

Tx Spur 10.6-18

Variant: DVD21 Tx Spur Tx Spur 10.6-18 PS 8, Channel: 3500.00 MHz, Chain a, Temp: 17, Voltage: 12 Vdc



There are no emissions found within 6dB of the limit line.

9.4.2. GPS Band Emissions

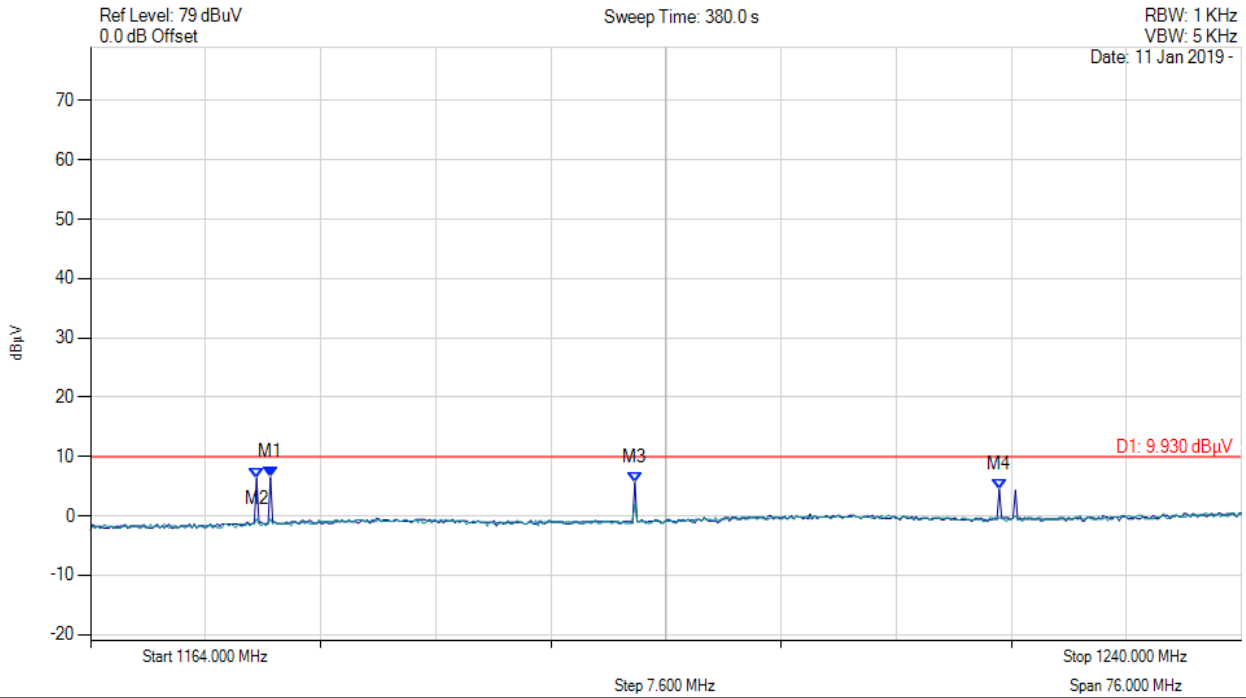
9.4.2.1. DVD21-POE

Equipment Configuration for GPS Spurious Emissions			
Antenna:	DVD21-POE	**Variant:**	500 MHz Bandwidth
Antenna Gain (dBi):	9.28	**Modulation:**	BPM/BPSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99%
Channel Frequency (MHz):	3500.00	**Data Rate:**	
Power Setting:	8	**Tested By:**	JMH

Test Measurement Results

GPS 1164-1240 MHz

Variant: DVD21 GPS 1164-1240 MHz, Channel: 3500.00 MHz, Chain a, Temp: 16, Voltage: 16 Vdc



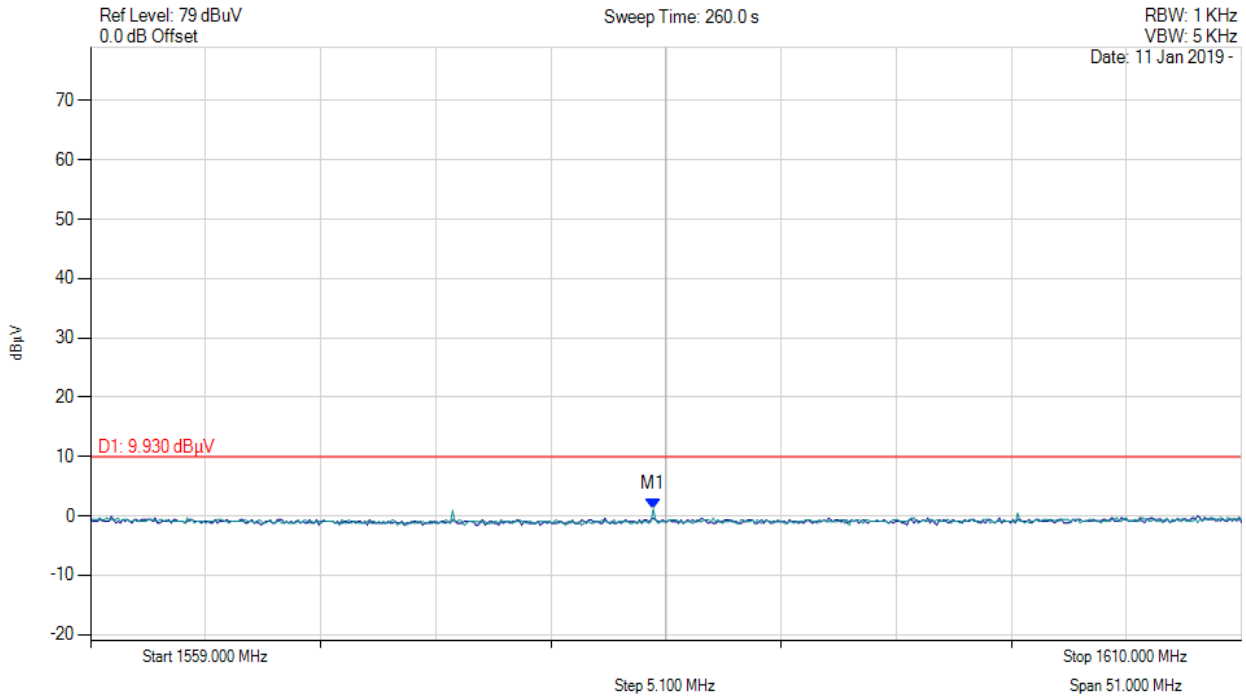
GPS 1164.00 - 1240.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	1175.88	22.28	1.25	-17.03	6.5	RMS	Vertical	150	0	9.9	-3.4	Pass
2	1174.97	22.14	1.25	-17.01	6.38	RMS	Vertical	150	0	9.9	-3.52	Pass
3	1199.94	21.84	1.21	-17.42	5.63	RMS	Vertical	150	0	9.9	-4.27	Pass
4	1224.01	19.76	1.26	-16.53	4.49	RMS	Vertical	150	0	9.9	-5.41	Pass

Equipment Configuration for GPS Spurious Emissions			
Antenna:	DVD21-POE	**Variant:**	500 MHz Bandwidth
Antenna Gain (dBi):	9.28	**Modulation:**	BPM/BPSK
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	99%
Channel Frequency (MHz):	3500.00	**Data Rate:**	
Power Setting:	8	**Tested By:**	JMH

Test Measurement Results

GPS 1559 - 1610 MHz

Variant: DVD21 GPS 1559 - 1610 MHz, Channel: 3500.00 MHz, Chain a, Temp: 16, Voltage: 16 Vdc

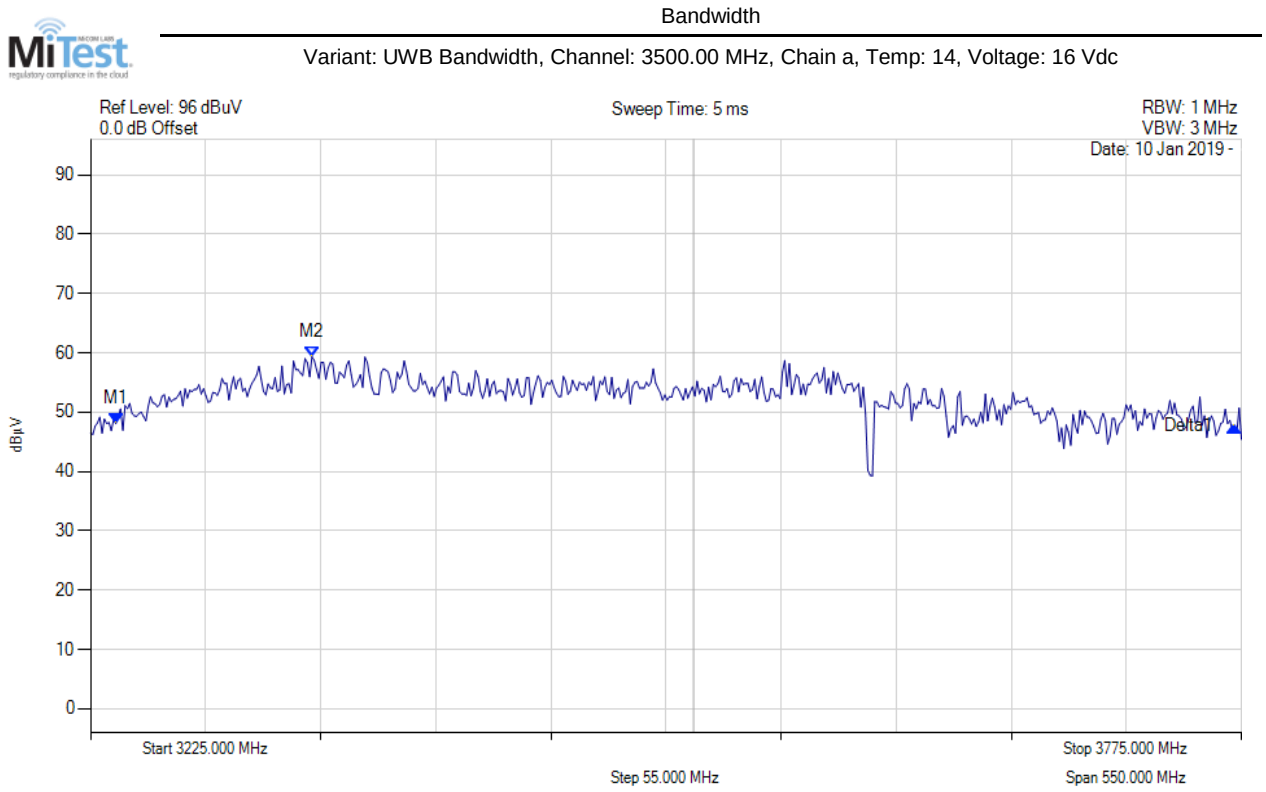


GPS 1559.00 - 1610.00 MHz												
Num	**Frequency MHz**	**Raw dBµV**	**Cable Loss dB**	**AF dB**	**Level dBµV/m**	**Measurement Type**	**Pol**	**Hgt cm**	**Azt Deg**	**Limit dBµV/m**	**Margin dB**	**Pass /Fail**
1	1583.94	16.226	1.42	-16.55	1.096	RMS	Horizontal	150	0	9.9	-8.804	Pass

A. APPENDIX - GRAPHICAL IMAGES

A.1. UWB Bandwidth

DVD21-POE



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 3261.022 MHz : 48.063 dBµV M2 : 3346.192 MHz : 59.343 dBµV Delta1 : 501.972 MHz : -0.401 dB	Channel Frequency: 3550.00 MHz

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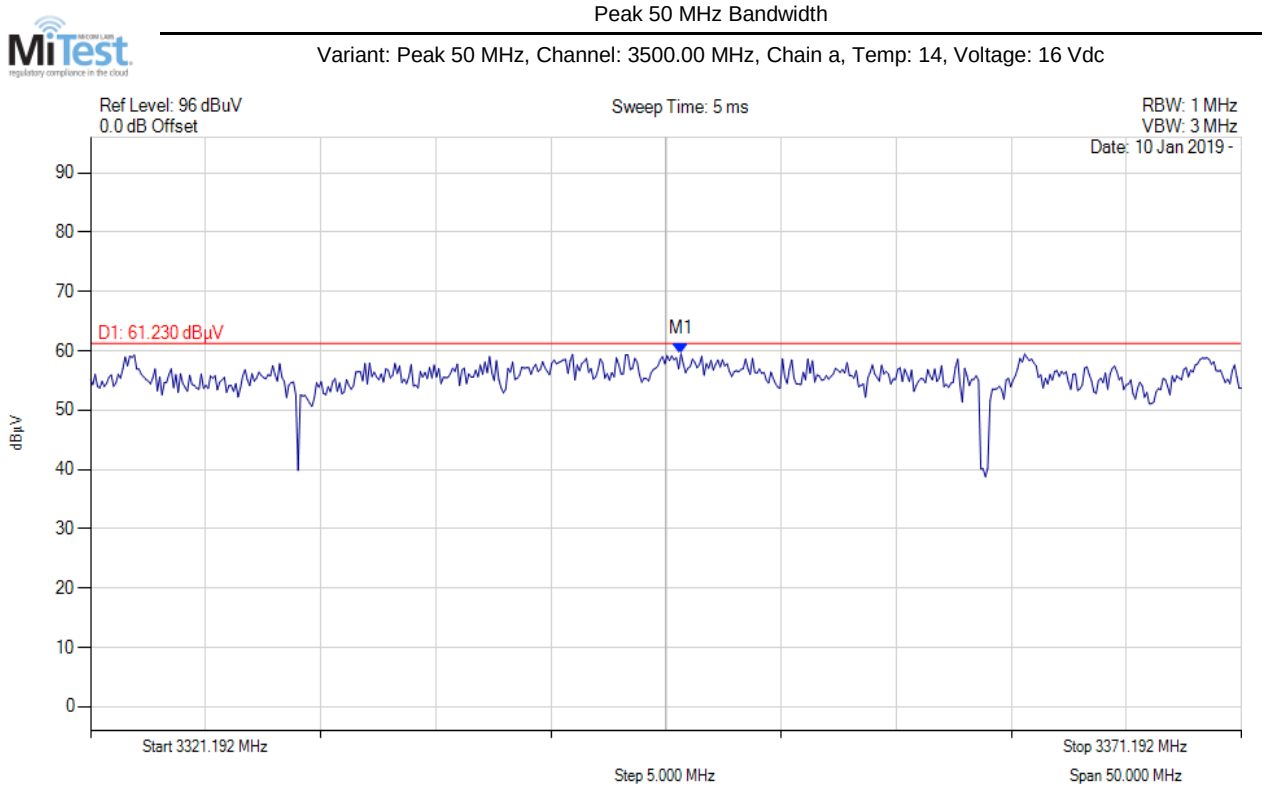
A.2. Peak Power Density

DVD21-POE – 50MHz Span



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 10 Trace Mode = VIEW	M1 : 3346.844 MHz : 59.505 dBµV	Channel Frequency: 3550.00 MHz

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